Soil Moisture Water Budget: Progress Report

Stephen Hundt

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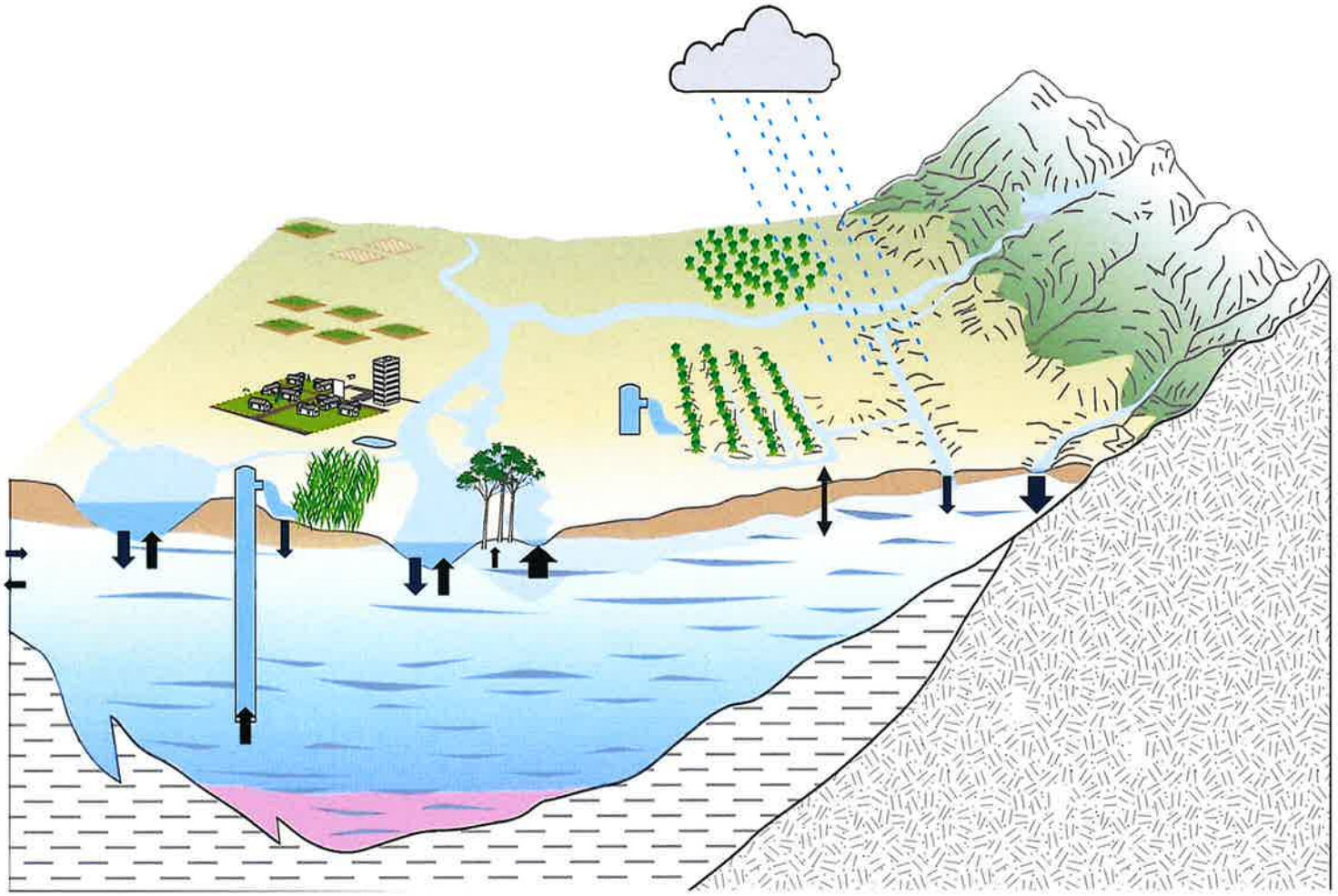
Reminder

We are making a groundwater flow model

Not all fluxes are measured directly



(modified from Faunt, 2009)

Aquifer System

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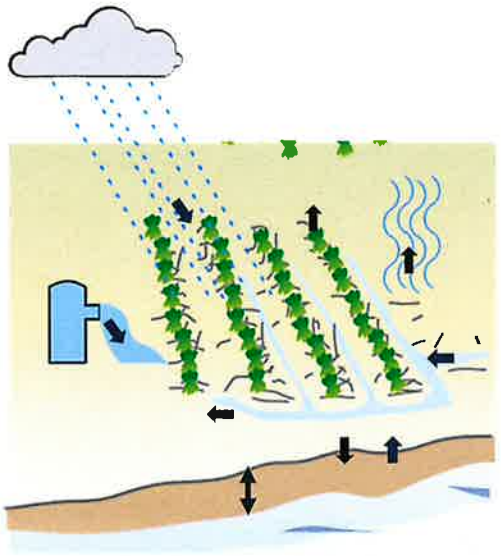
Reminder

Look at components of hydrologic cycle

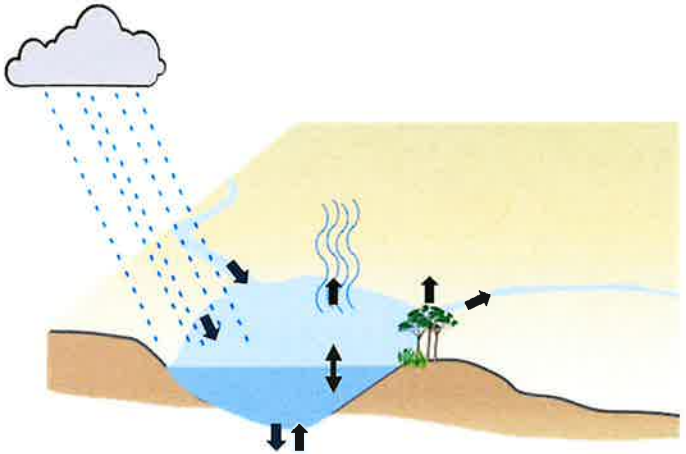
Back out GW fluxes with:

In – Out = ±ΔStorage



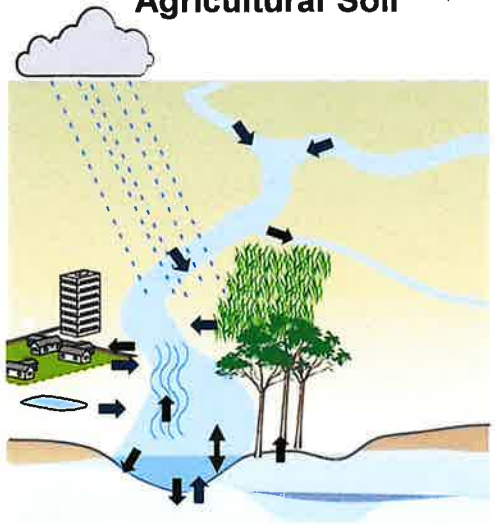
Agricultural Soil

(modified from Faunt, 2009)



Lakes (Lowell)

(modified from Faunt, 2009)



Rivers

(modified from Faunt, 2009)

Urban

(modified from Faunt, 2009)

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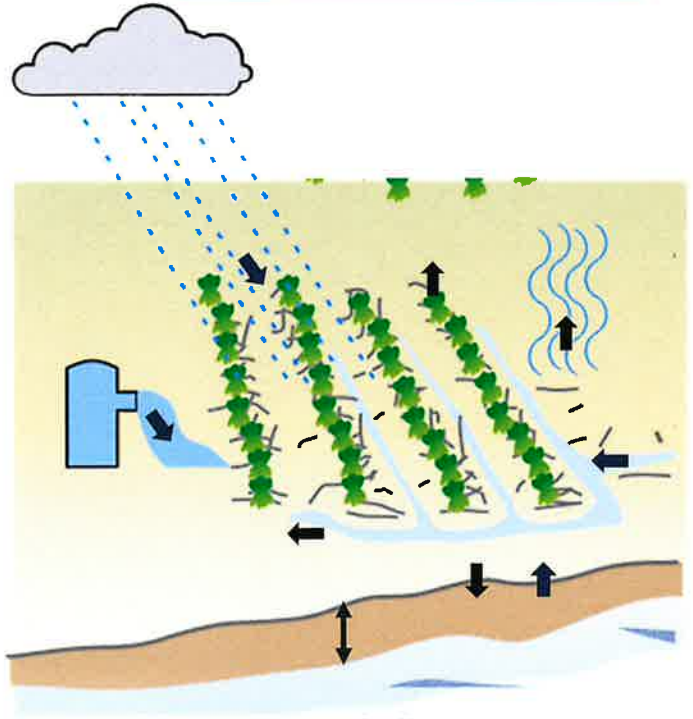
Soil Moisture Budget

In	–	Out	=	±ΔStorage
precipitation		evaporation (irrigation and bare soil)		Δ soil moisture
surface water deliveries		transpiration		
groundwater deliveries		runoff		
groundwater uptake		**deep percolation to groundwater**		



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(modified from Faunt, 2009)

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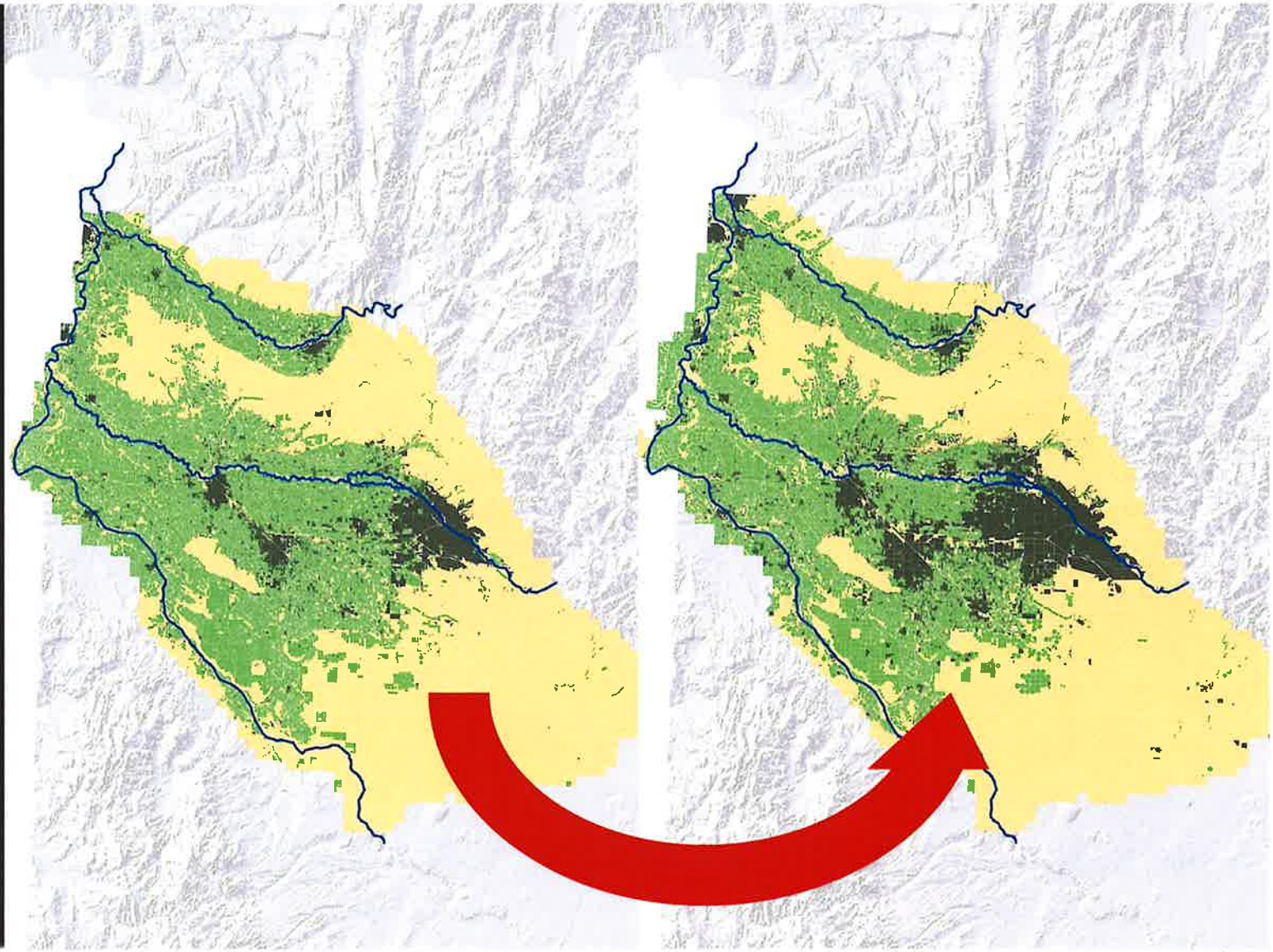
Importance

Scenarios of land use changes

Will largely affect aquifer predictions by changing location, timing, and volume of water infiltrating into soil



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Importance

Greater Potential ET with warming climate

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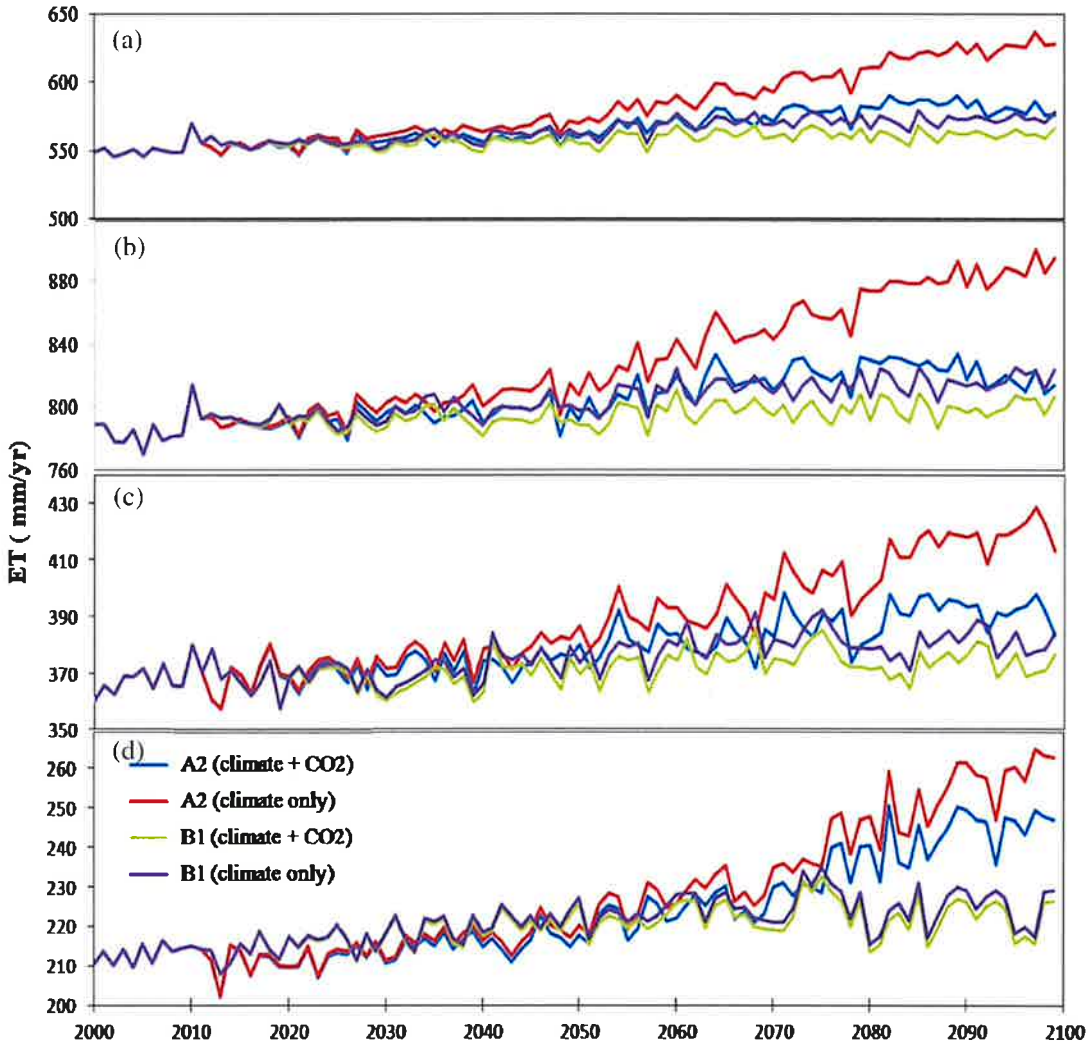

Pan, S., Tian, H., Dangal, S. R., Yang, Q., Yang, J., Lu, C., Tao, B., Ren, W. and Ouyang, Z. (2015), **Responses of global terrestrial evapotranspiration to climate change and increasing atmospheric CO_2 in the 21st century**. Earth's Future, 3: 15-35. doi:

Importance

Recharge from precipitation and applied irrigation are significant portion of total inflows

Pumping is a large outflow

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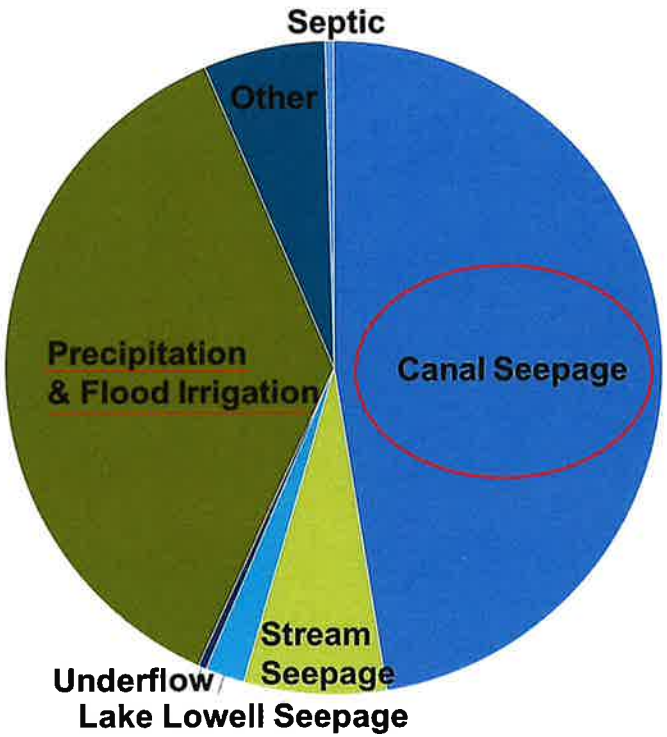
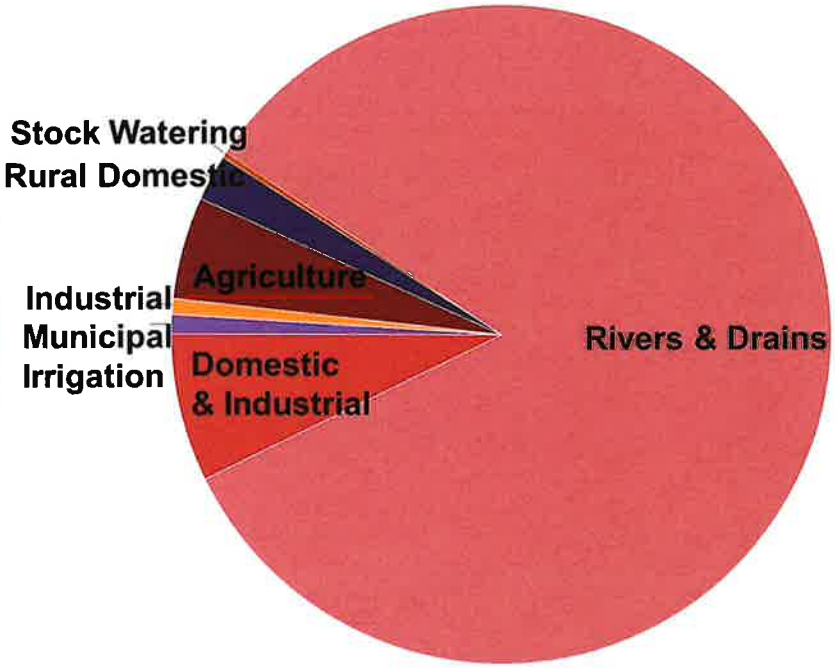
Inflows
(Urban, 2004)



Outflows
(Urban, 2004)



Soil Moisture Budget

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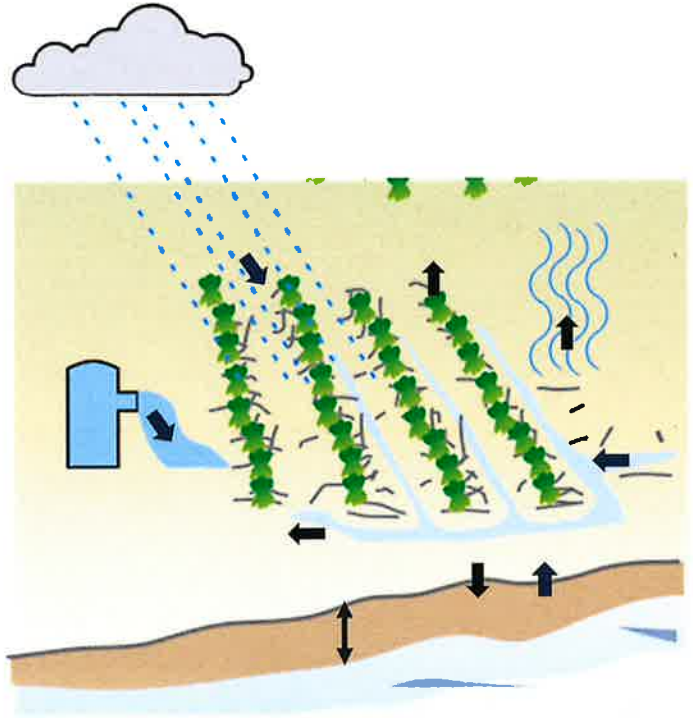

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(modified from Faunt, 2009)

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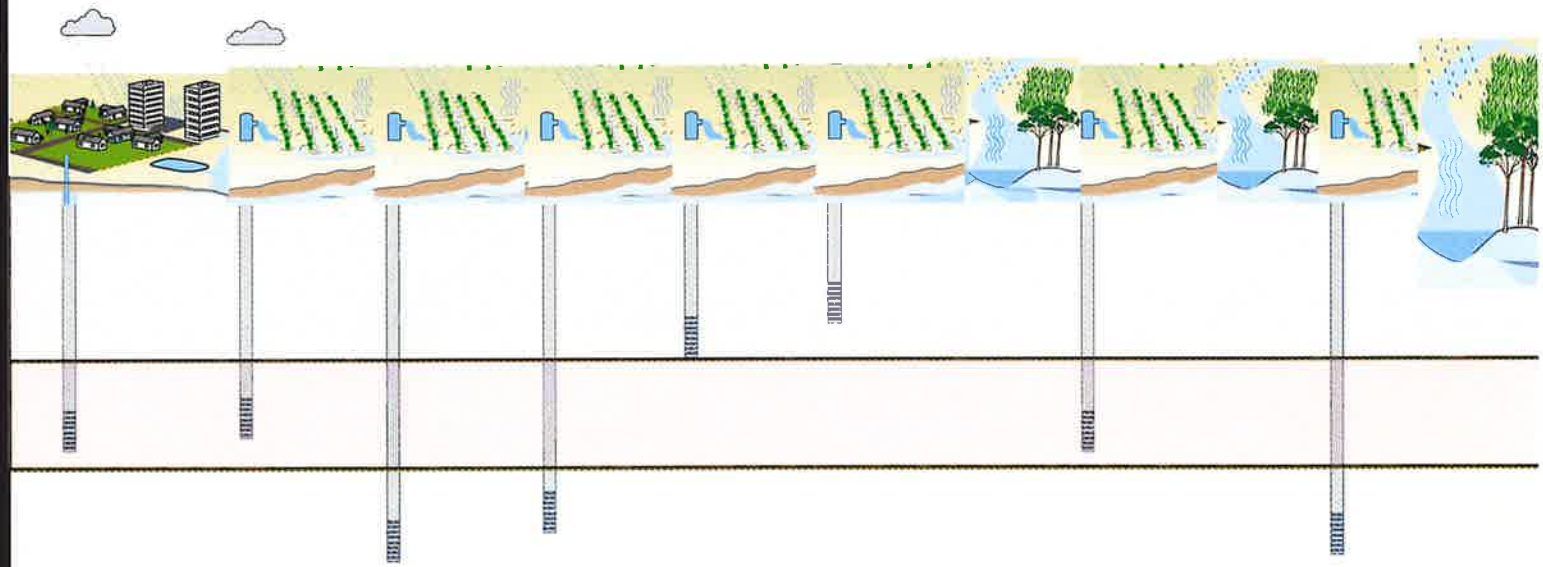
Soil Moisture / Irrigation System Budget



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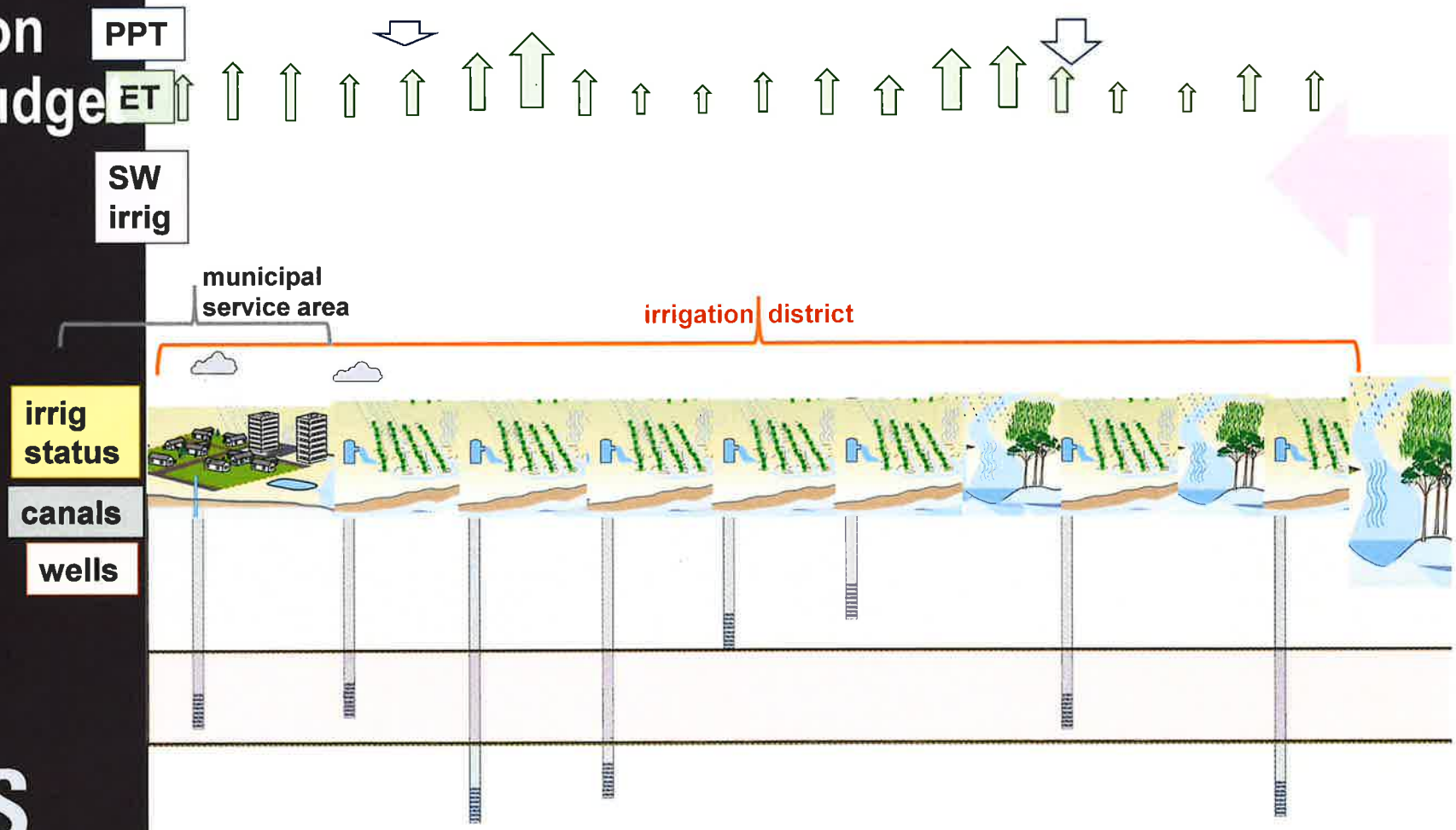
Soil Moisture / Irrigation System Budget



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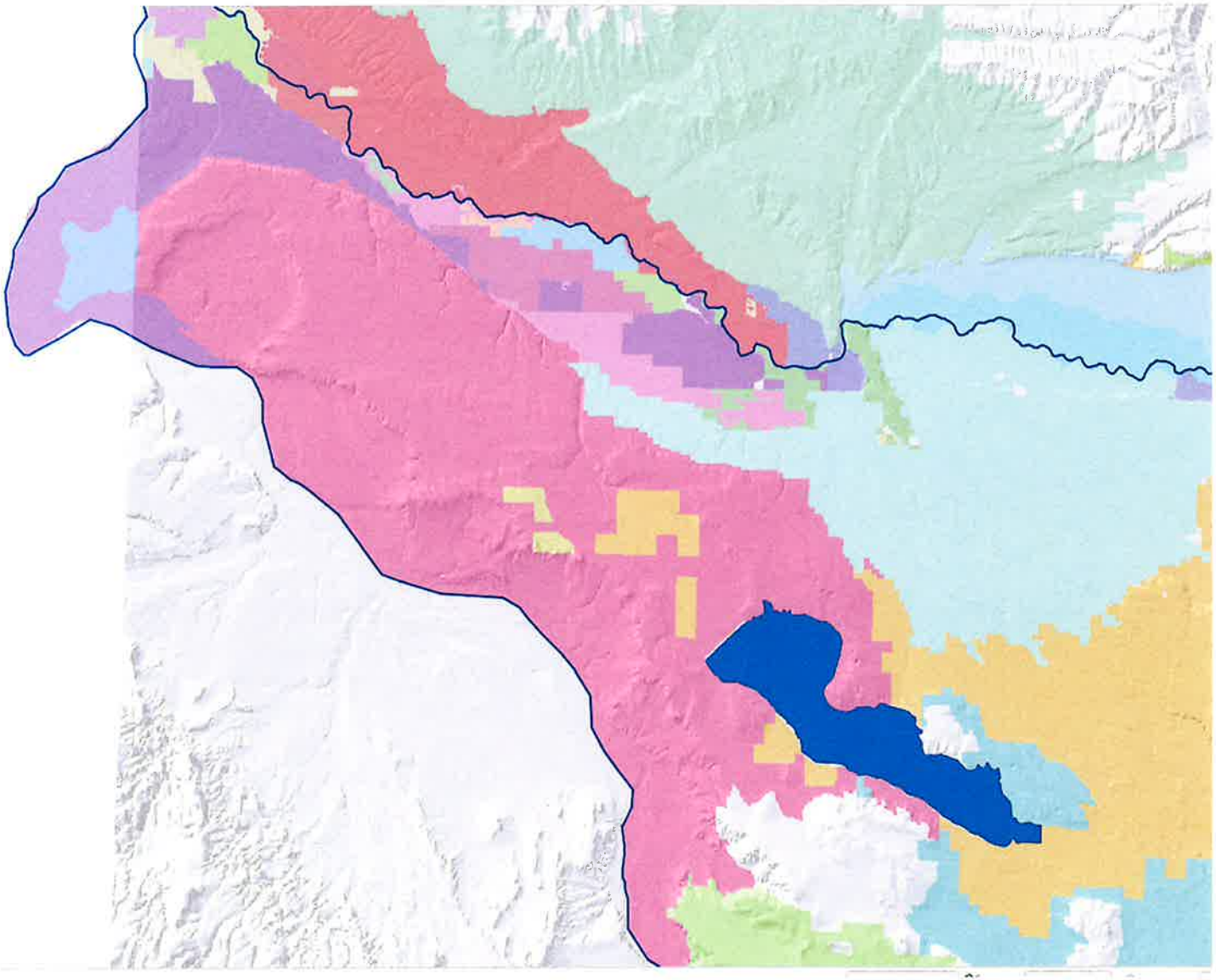
Scales

- **Irrigation District**



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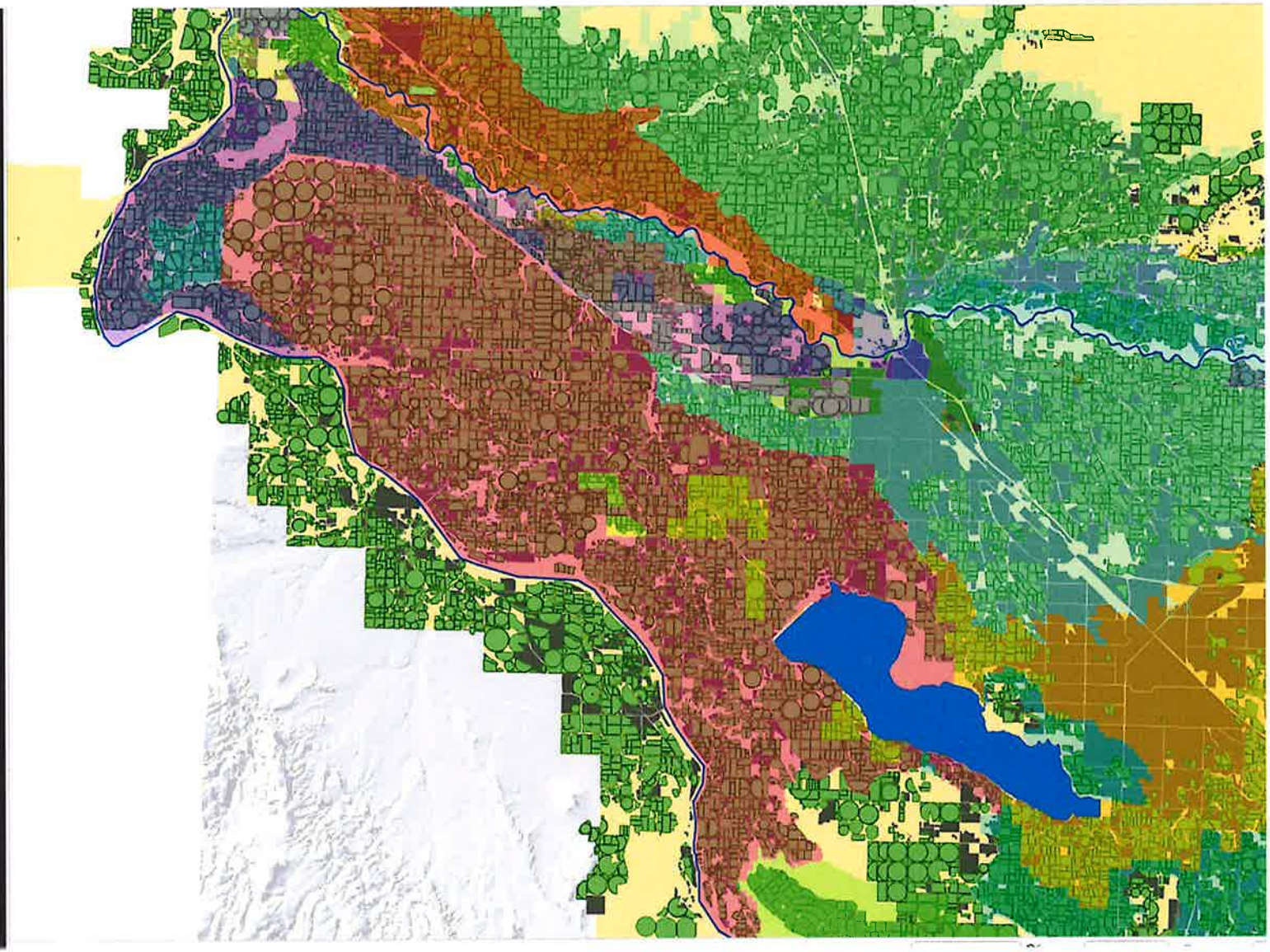
Scales

- **Irrigation District**

- Field



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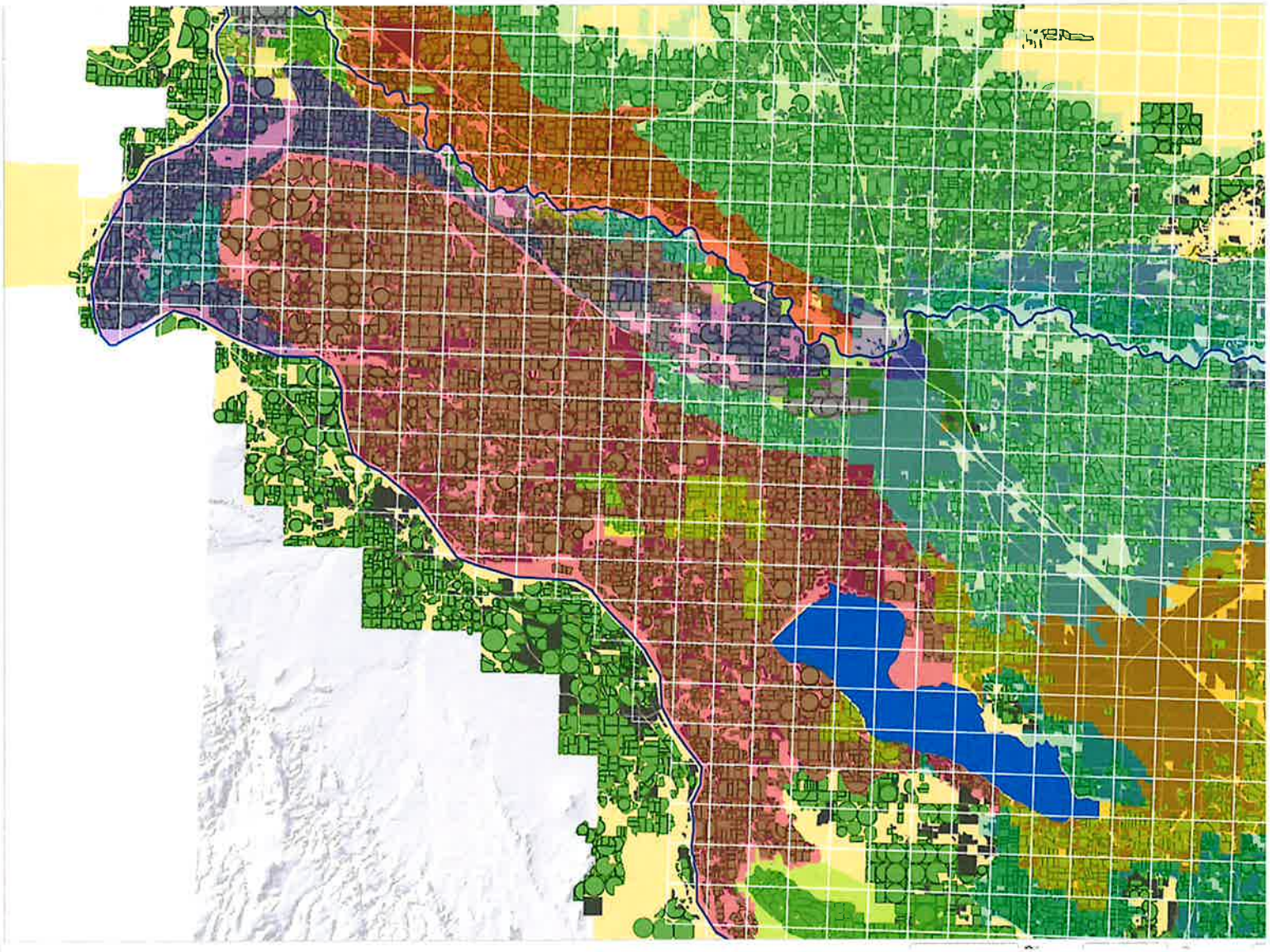
Scales

- **Irrigation District**
- Field
- Grid Cell



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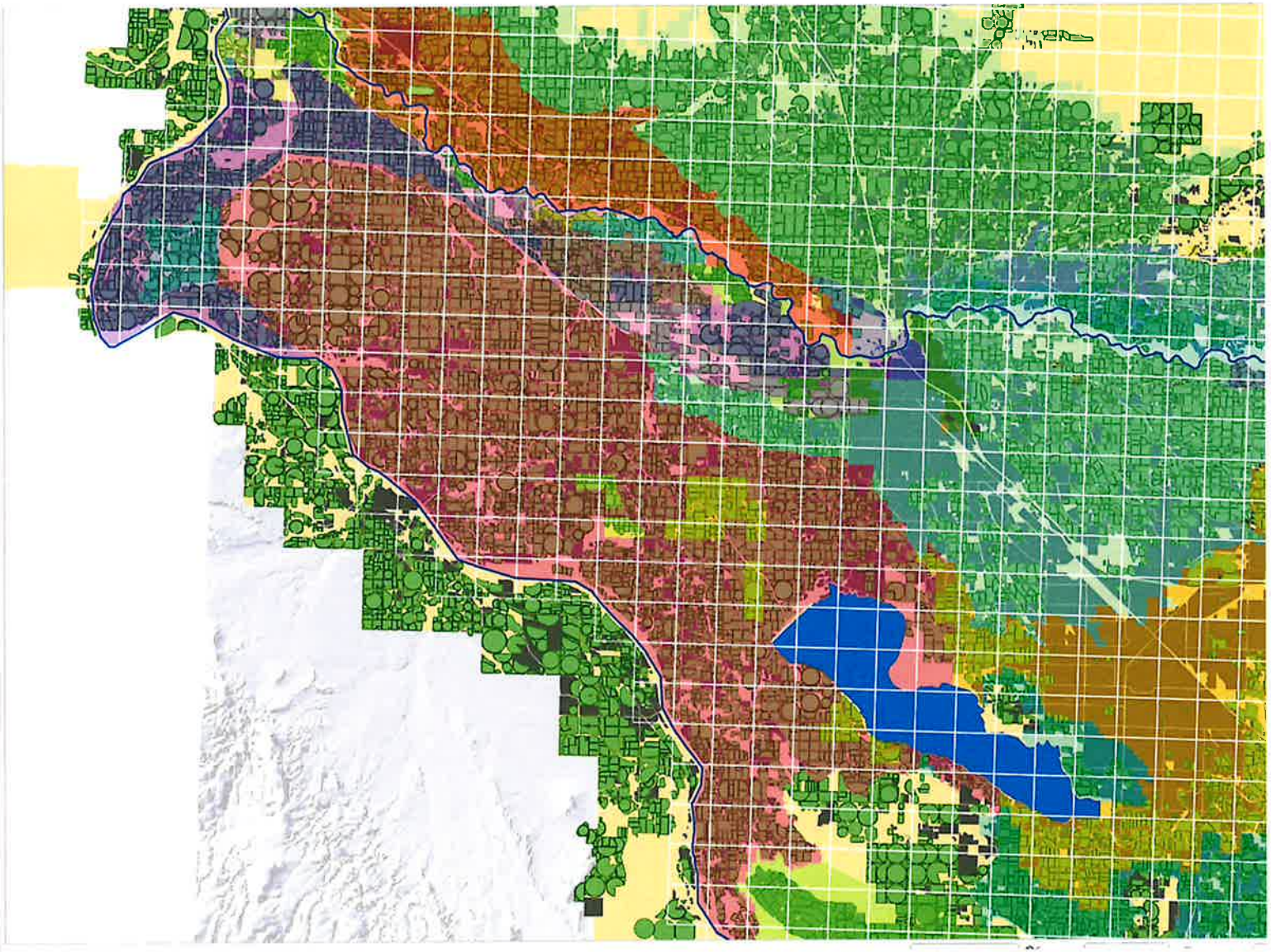
Scales

- **Irrigation District**
  - SW distribution:
    - canal losses
    - field deliveries
- Field
  - Soil Moisture:
    - recharge
    - pumping
- Grid Cell
  - Aggregated field:
    - recharge
    - pumping
  - Distributed canal losses



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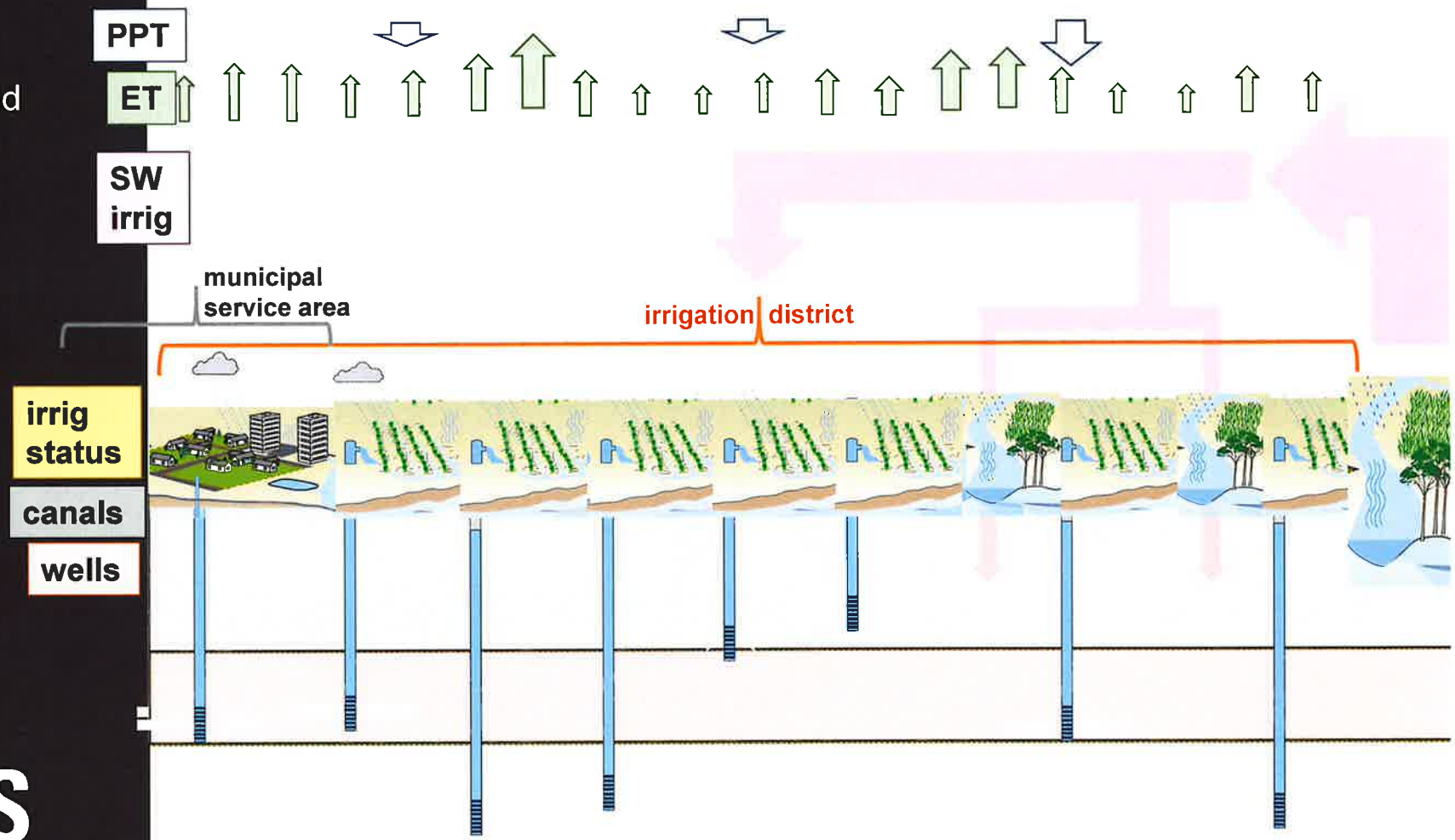
Scales

District and field scale budgets



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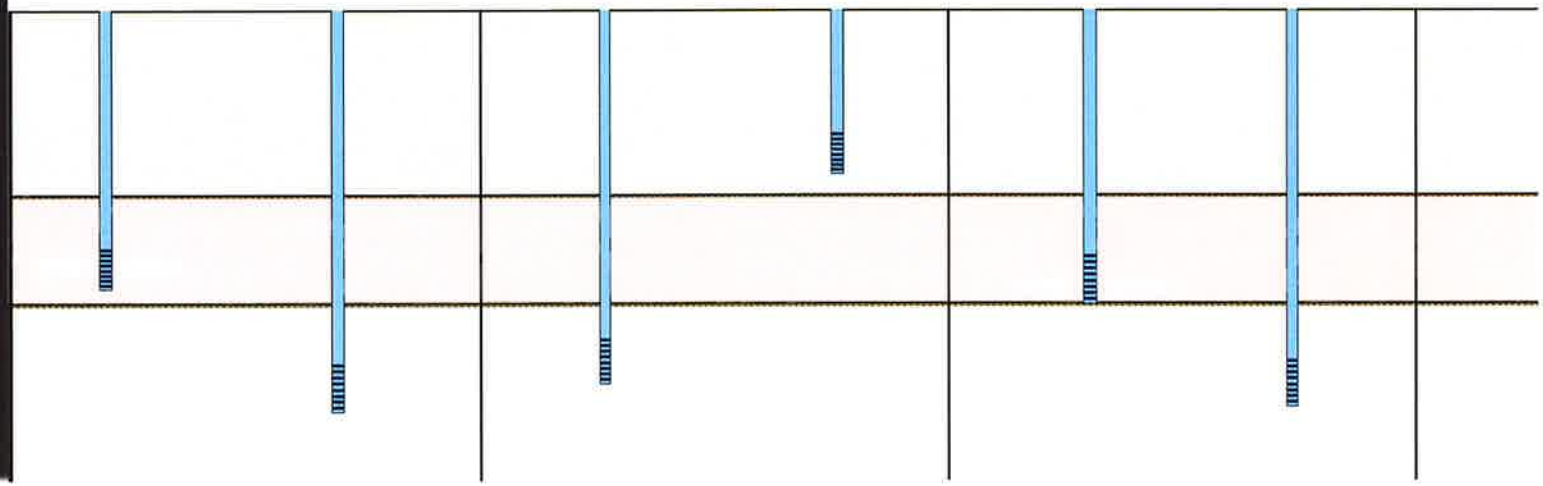
Scales

To grid cells



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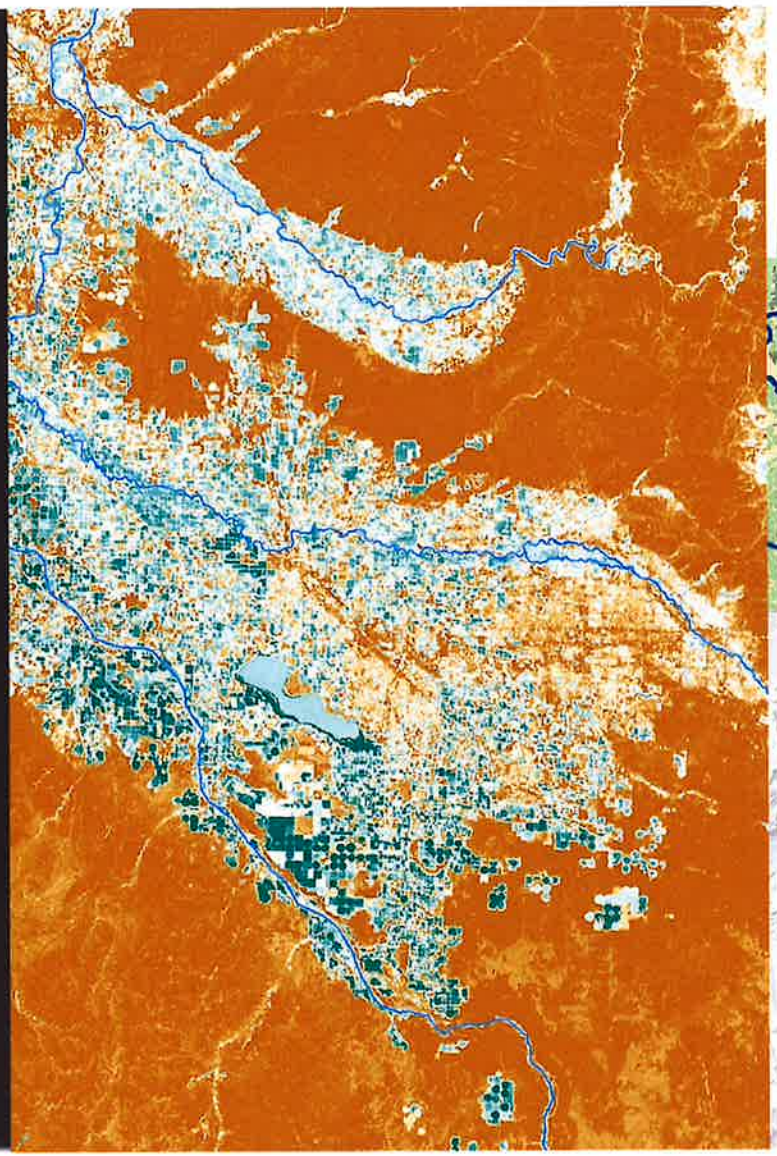
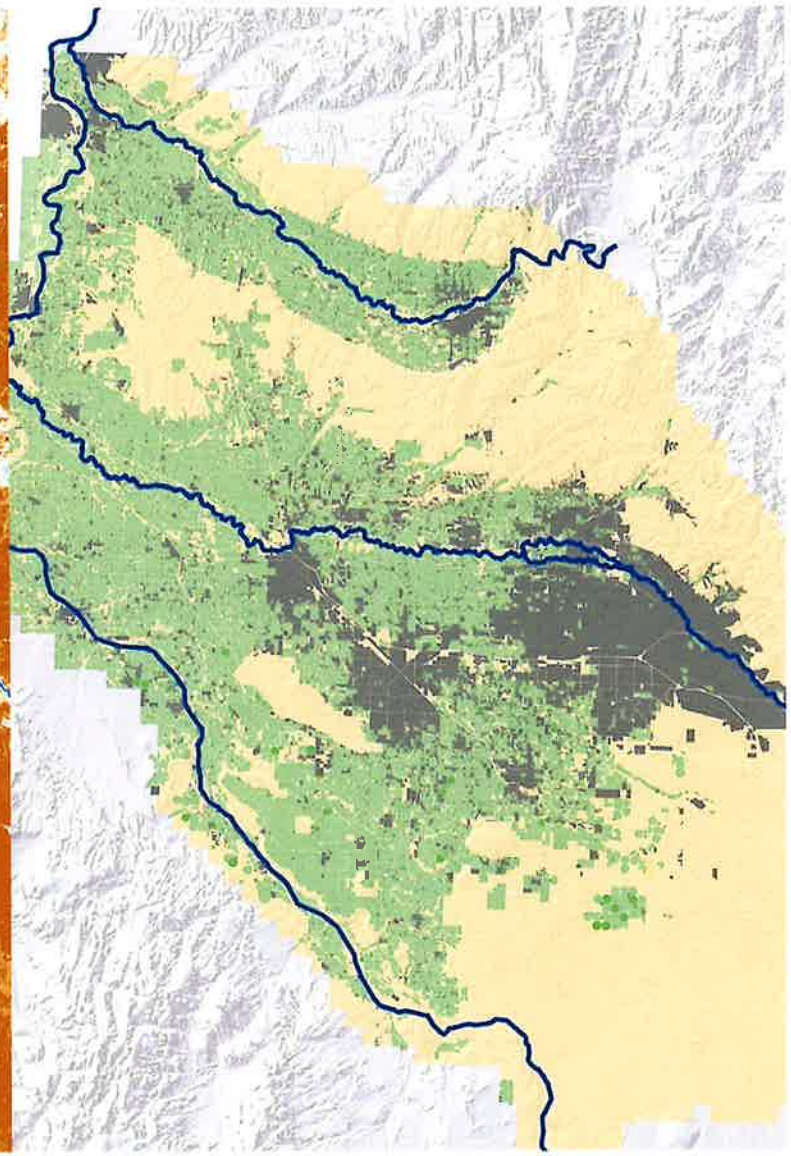
ET Processing

Irrigated Lands +
METRIC





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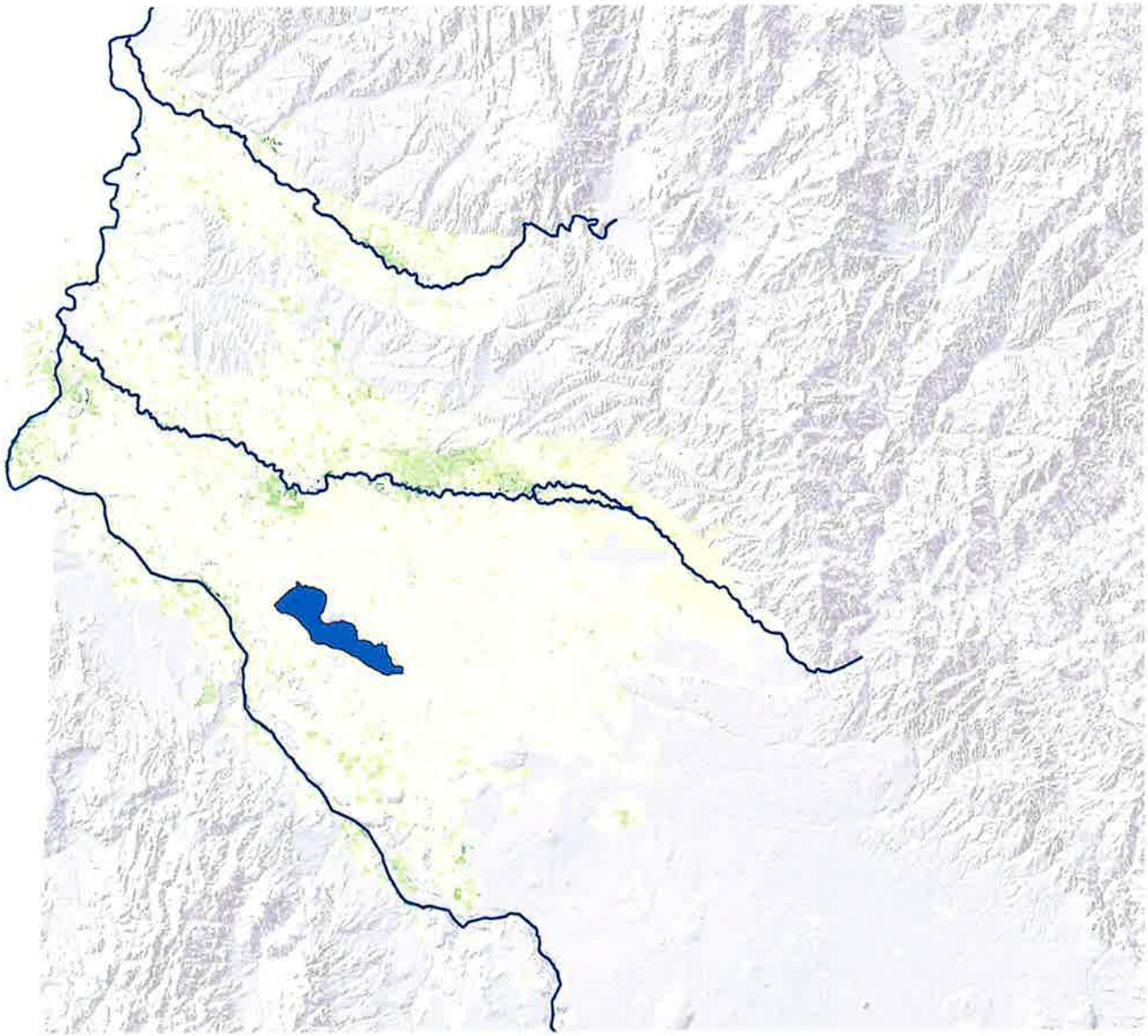
ET Processing

March 2015

Irrigated
Semi-irrigated

(preliminary)



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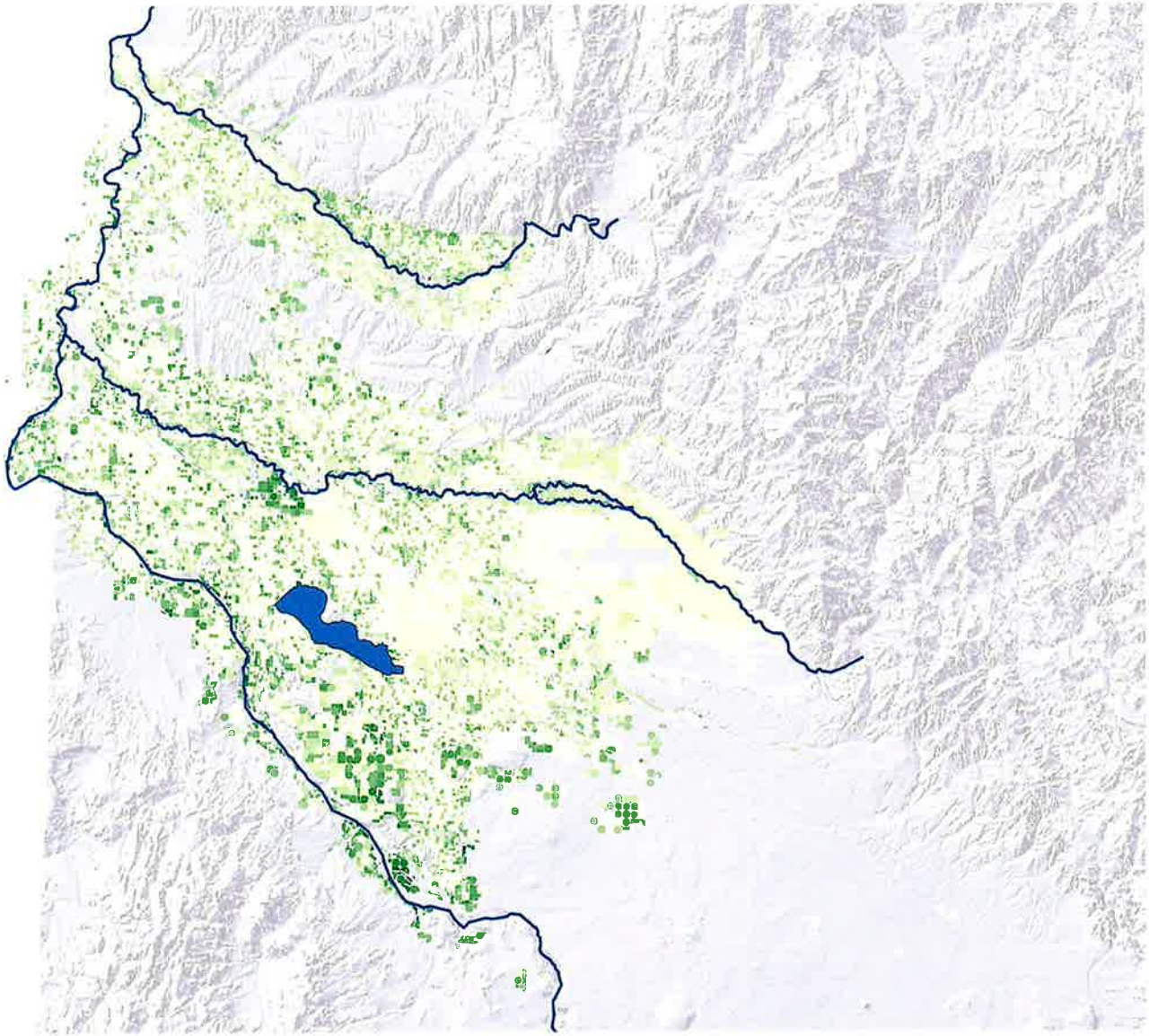
ET Processing

April 2015

Irrigated
Semi-irrigated

(preliminary)



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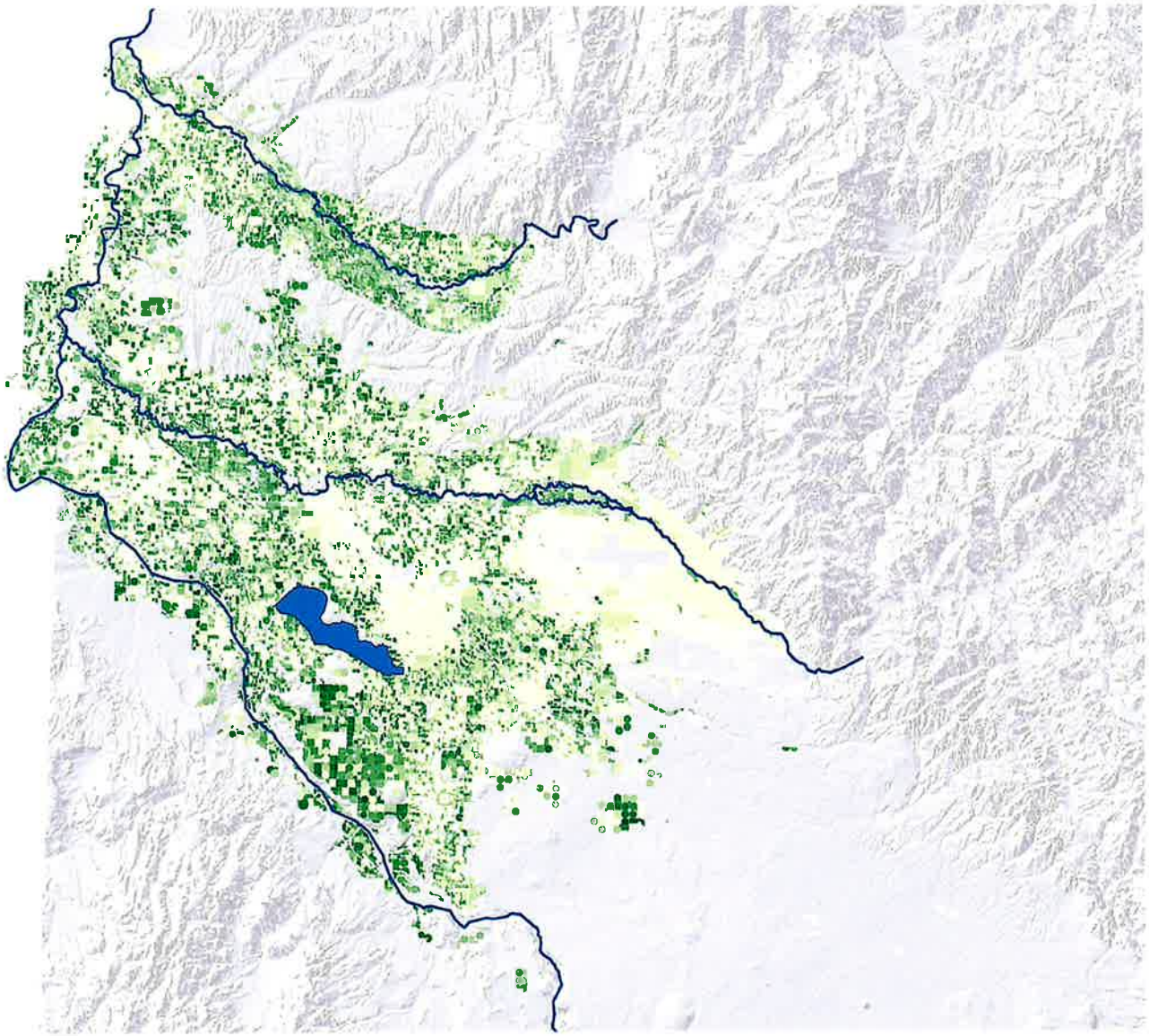
ET Processing

May 2015

Irrigated
Semi-irrigated

(preliminary)



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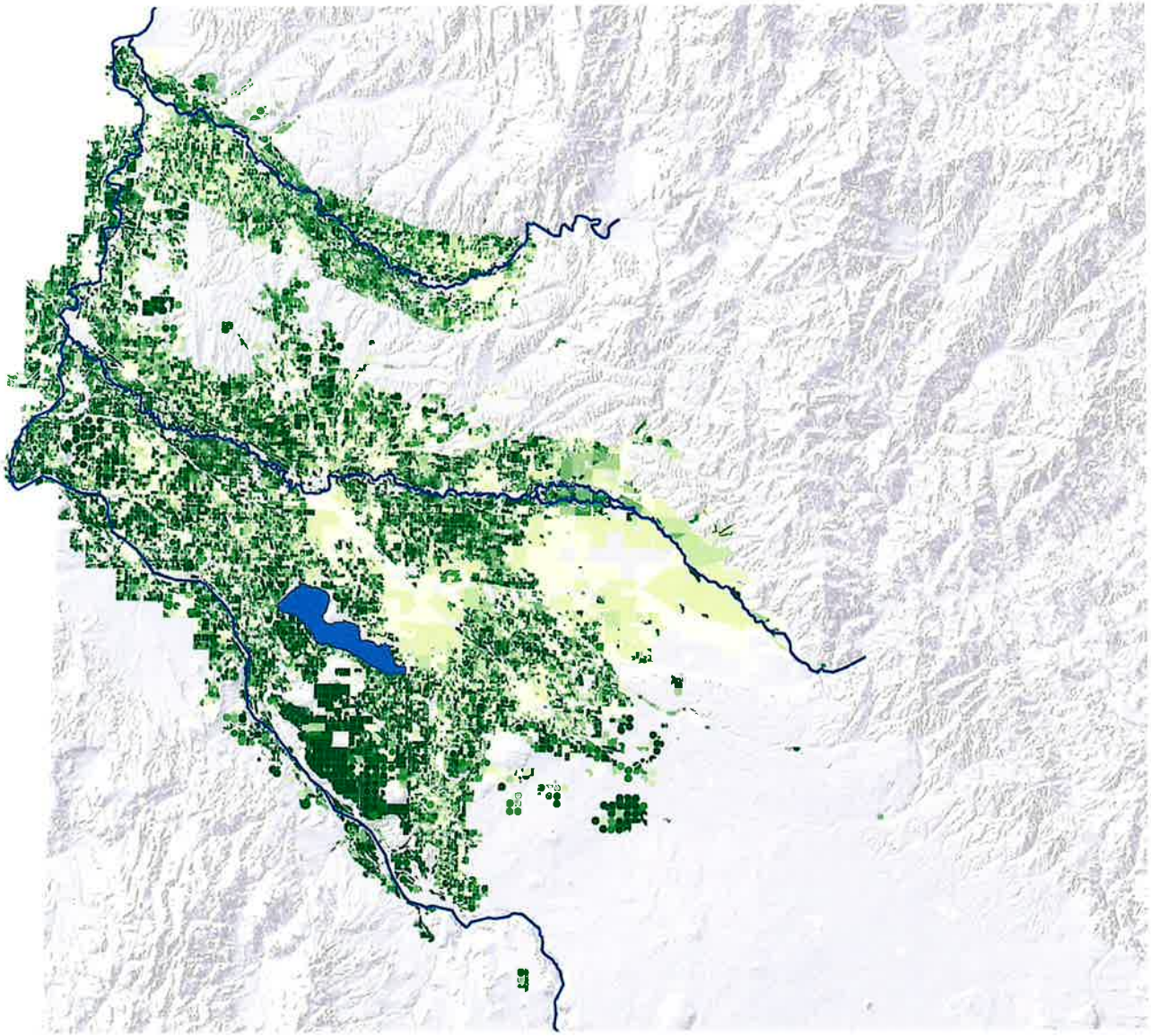
ET Processing

June 2015

Irrigated
Semi-irrigated

(preliminary)



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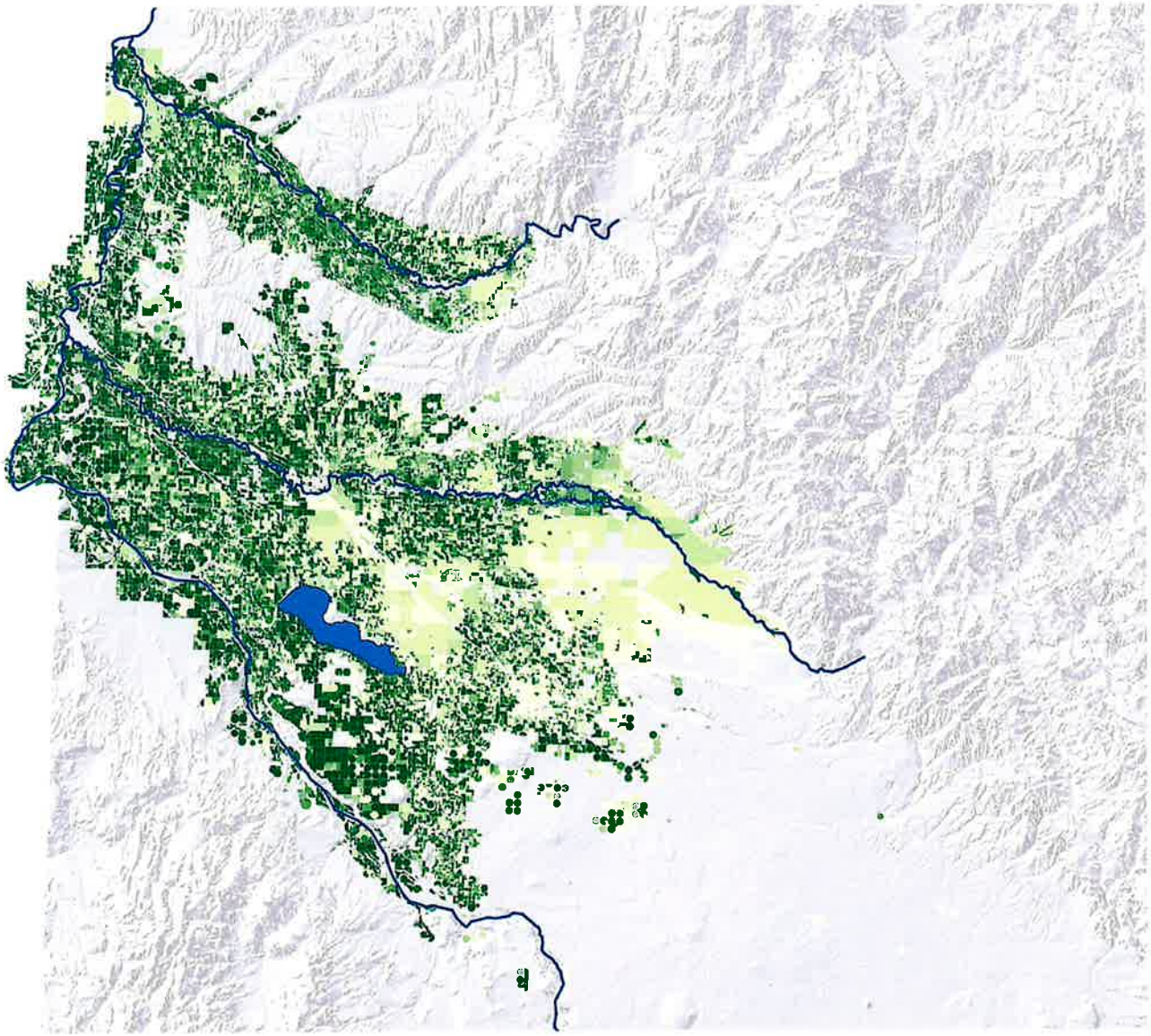
ET Processing

July 2015

Irrigated
Semi-irrigated

(preliminary)



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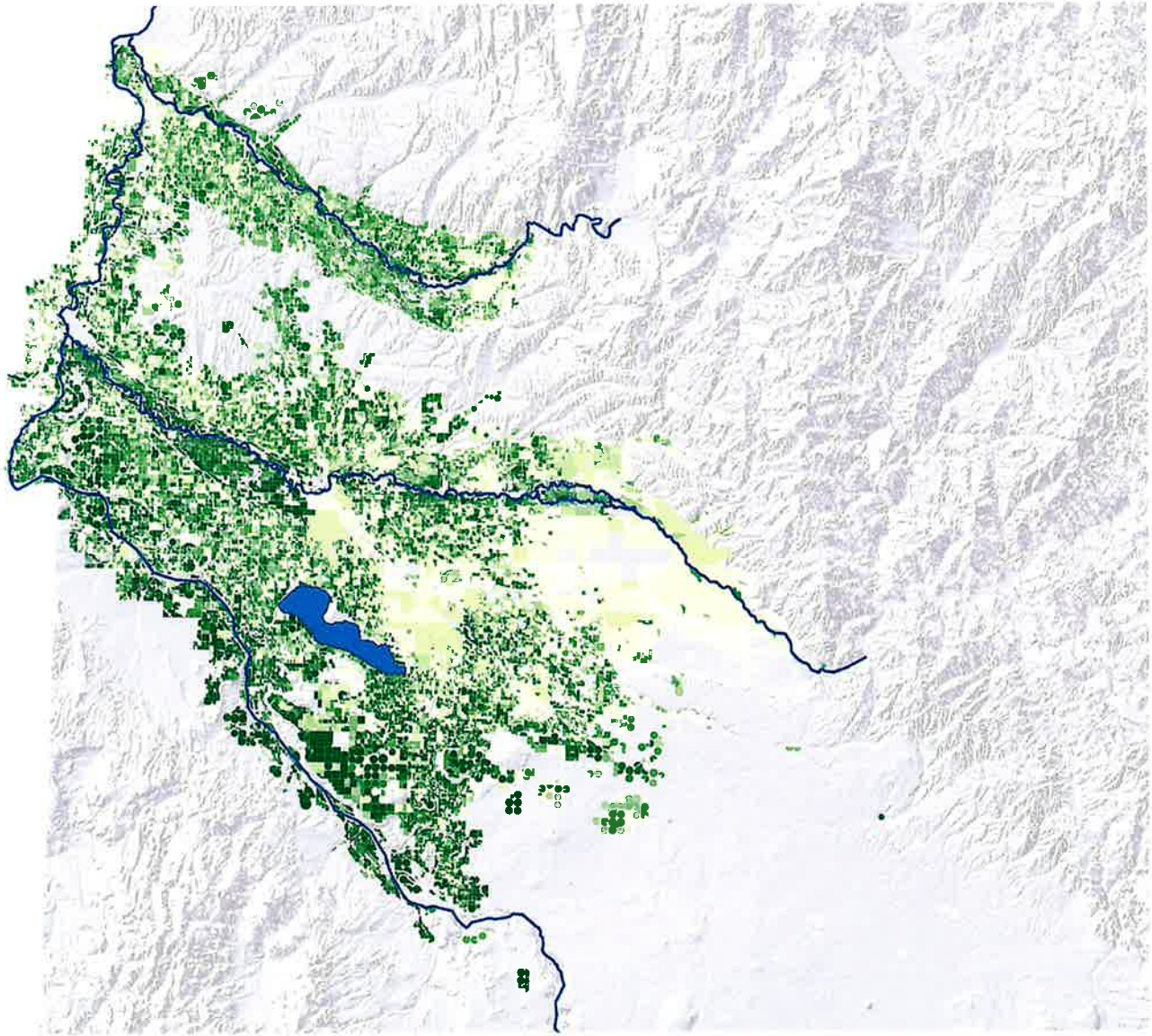
ET Processing

August 2015

Irrigated
Semi-irrigated

(preliminary)



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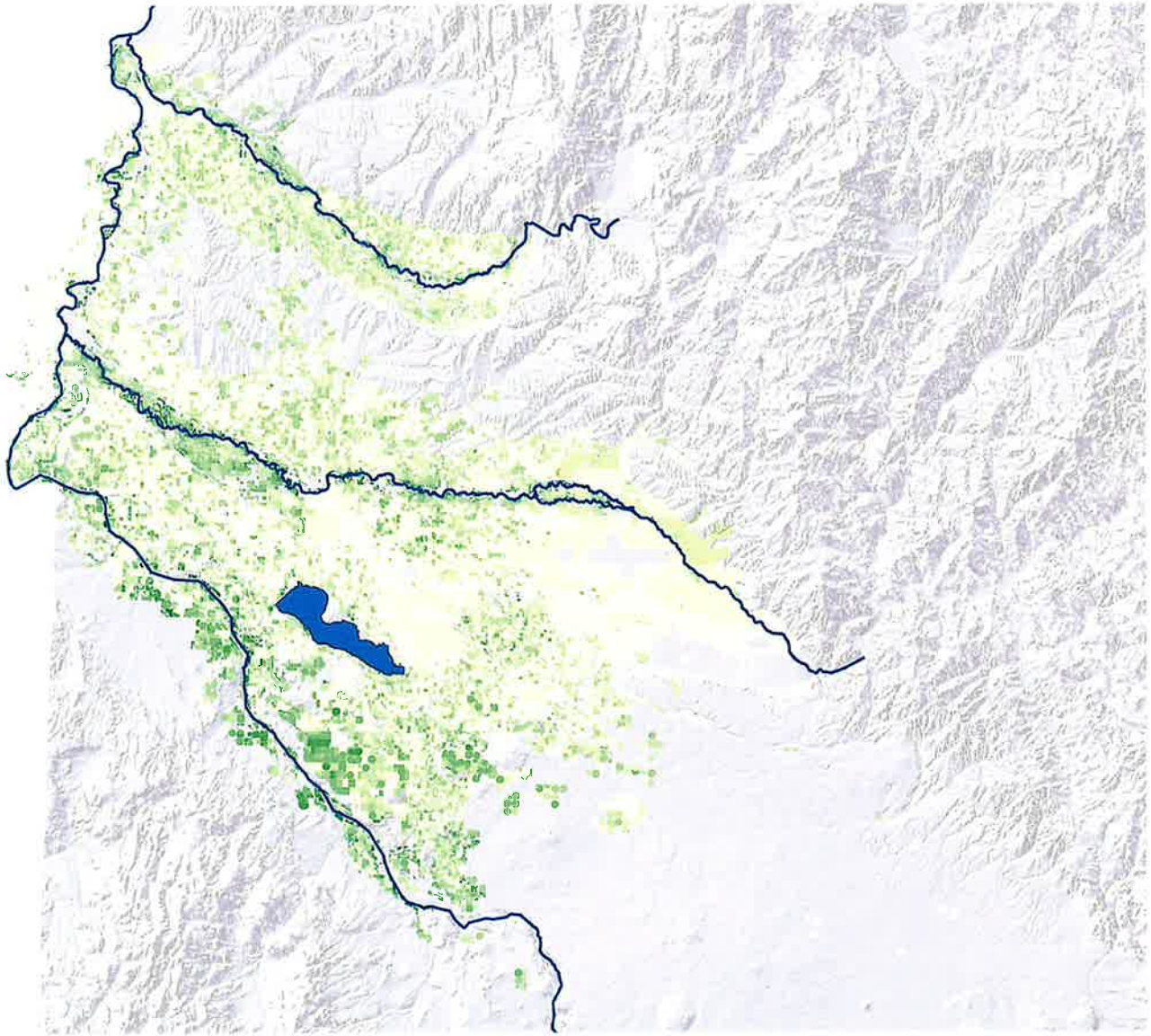
ET Processing

September 2015

Irrigated
Semi-irrigated

(preliminary)



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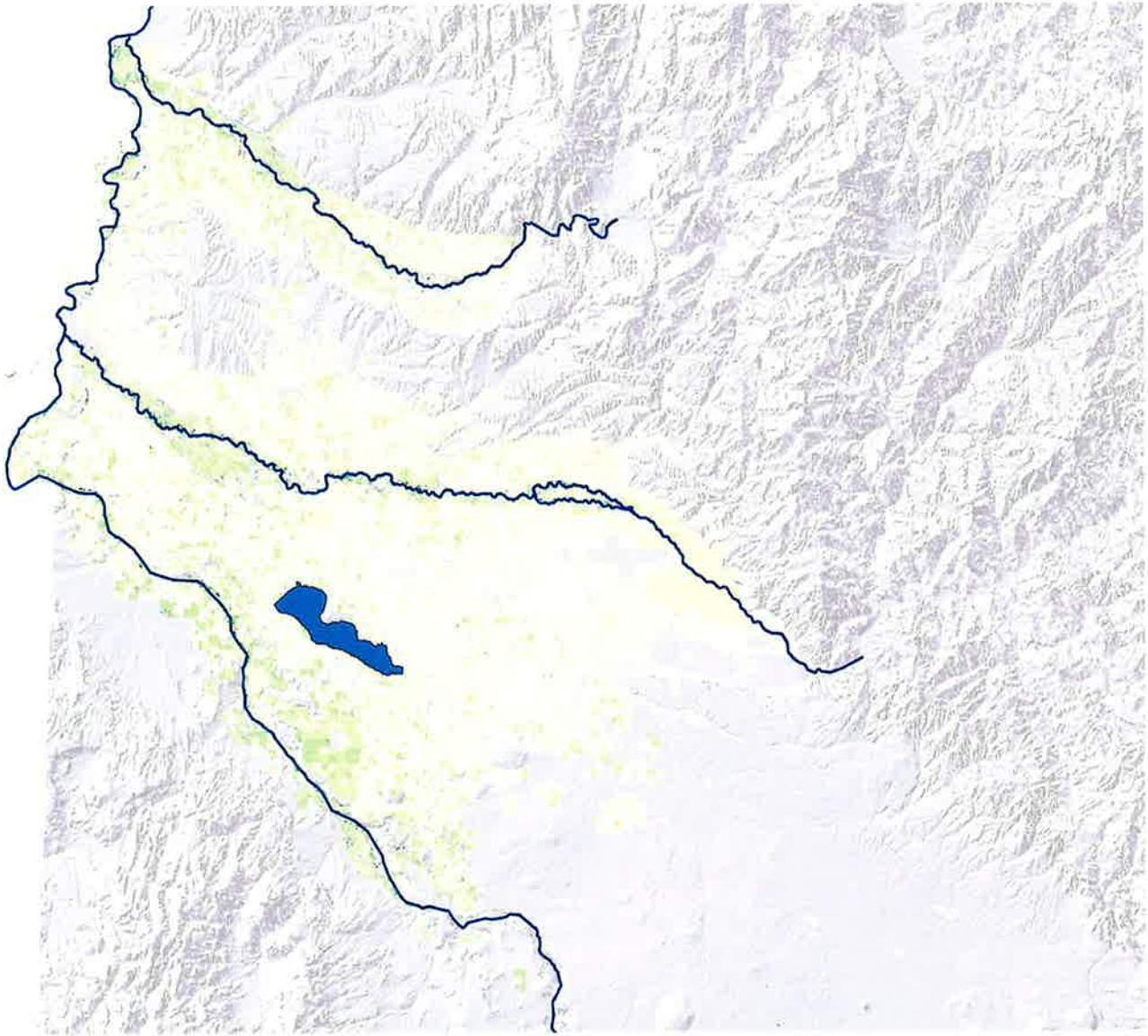
ET Processing

October 2015

Irrigated
Semi-irrigated

(preliminary)



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ET Processing

Elevated ET beyond edge of irrigated areas

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ET Processing

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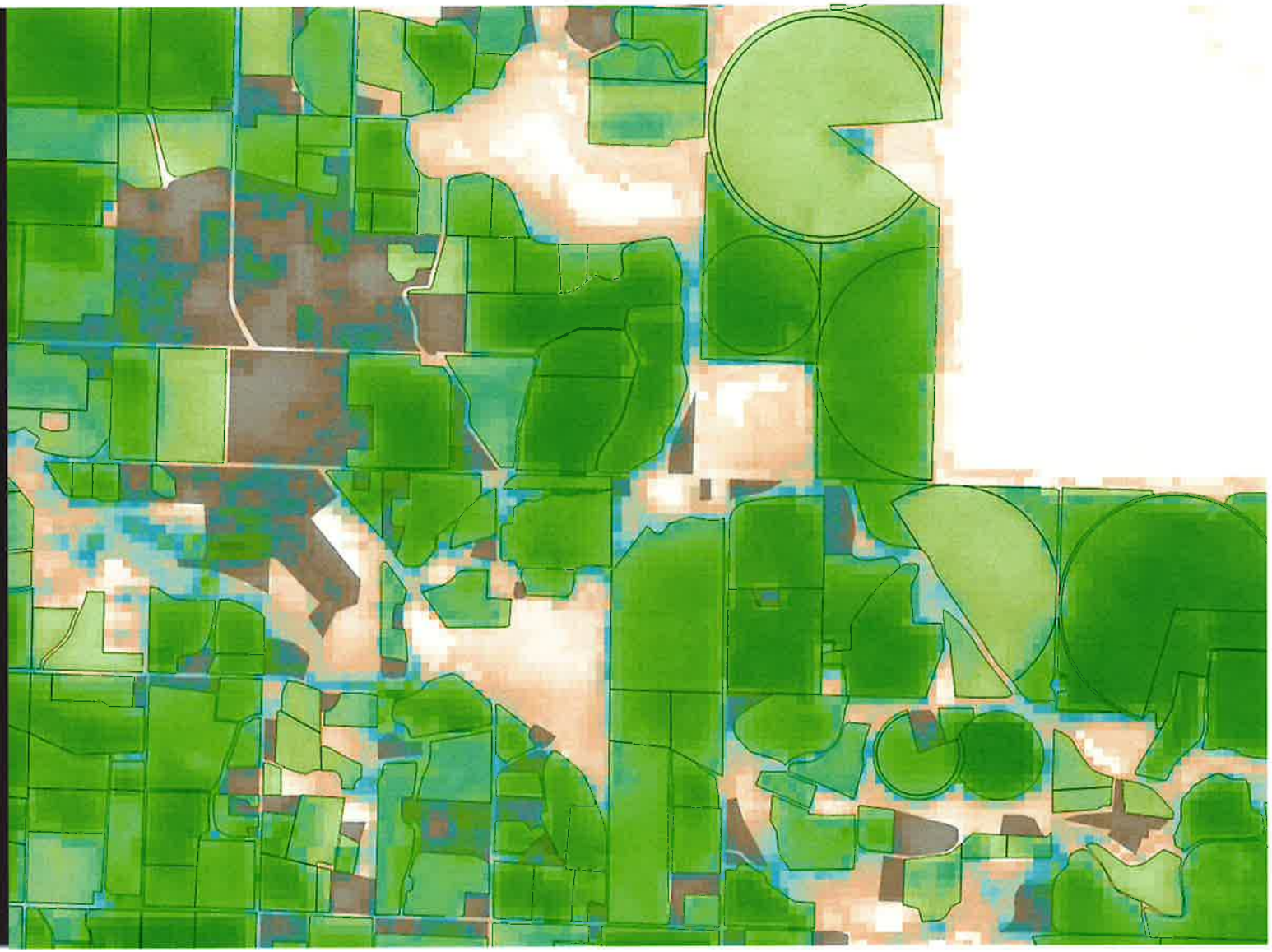
ET Processing

Elevated ET beyond edge of irrigated areas



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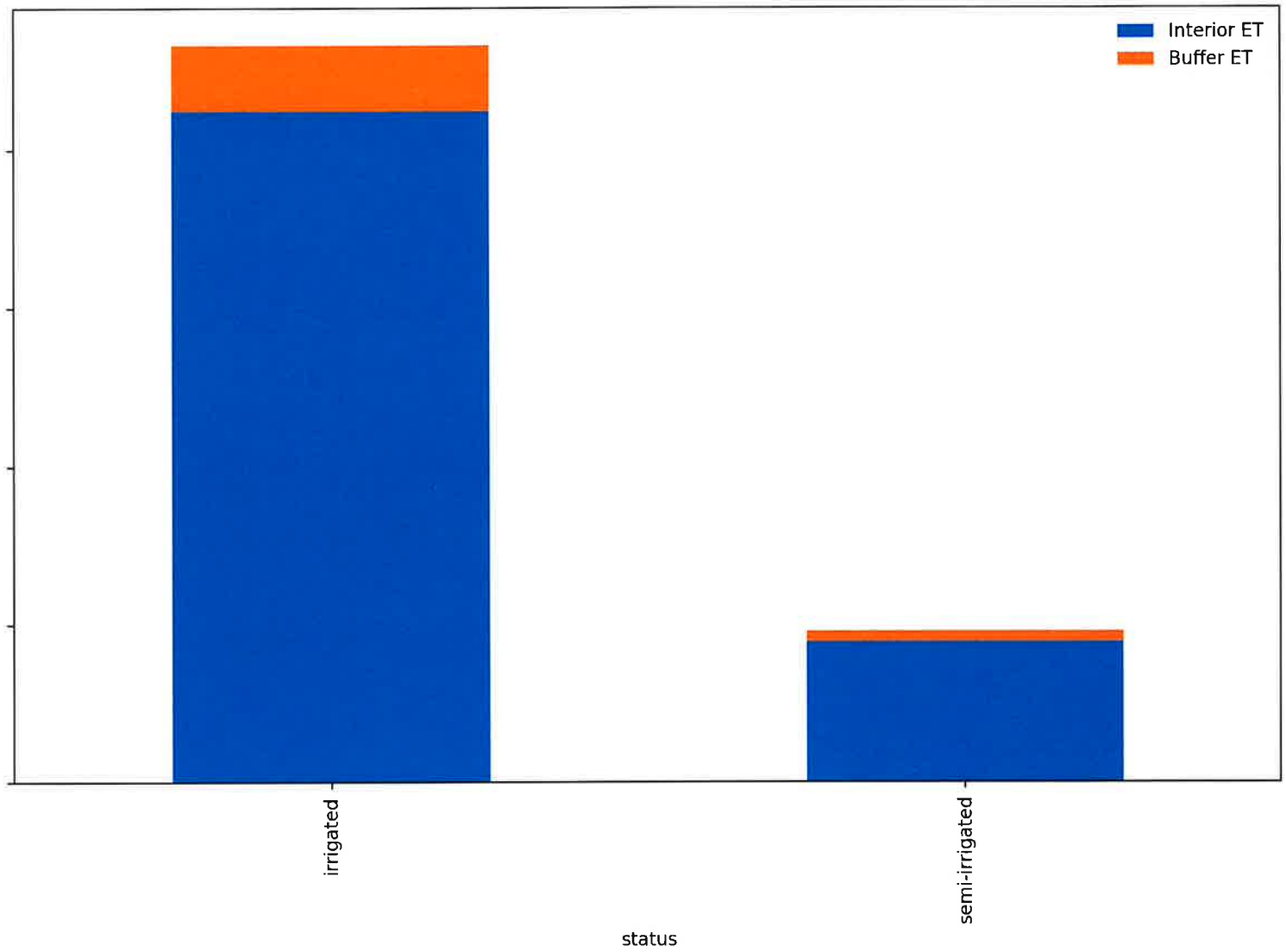
Processing Progress: PPT



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Soil Moisture Budget

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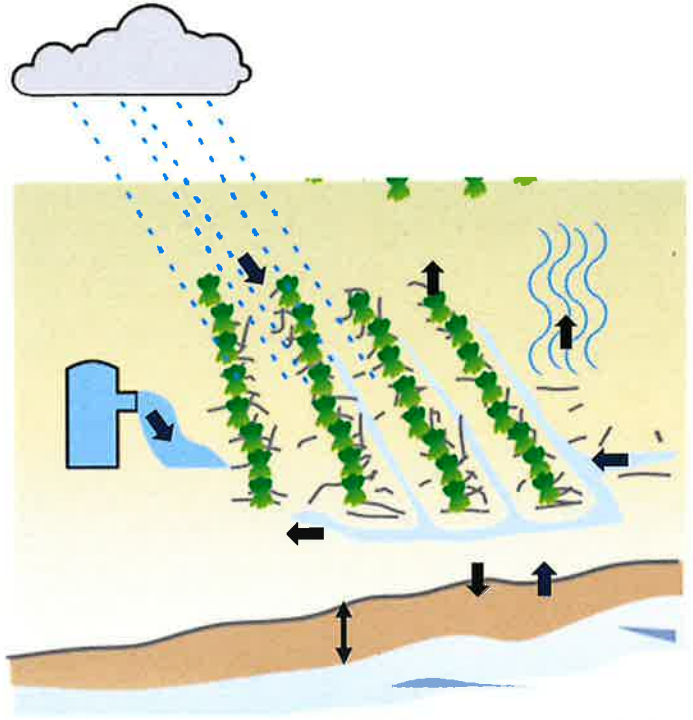

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(modified from Faunt, 2009)

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Potential Assumptions

Considerations:

- Model accuracy
- Level of effort
- Parameterization / what is sensitive in scenarios

Soil moisture state

- Calculate changes in soil moisture state
- No storage in soil

Percolation

- Soil percolation rate x moisture state
- PPT – ET in non-irrigation season
- % of deliveries in irrigation season

Canal loss volume

- Fixed
- Adjustable parameter to calibrate

Canal loss distribution

- Proportional to area in district
- Concentrate at larger canals within district

Surface water deliveries

- Distribute by field area
- Distribute by net demand (ET – ppt ±Δ soil moisture)
- Distribute to fields without GW right, then remaining to those with GW

Layer of pumping

- Relate wells to fields; include individual wells by needed supplemental water on field
- Get general pumping depths for cells or regions & distribute pumping accordingly

Pumping volume and location

- Residual of water budget (demand – supply)

Thanks for listening!

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